

## **EUV Lithography at the Threshold of High Volume Manufacturing**

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After decades of research and development, EUV lithography is poised for use in high volume manufacturing (HVM). For the first generation of manufacturing in which EUV lithography will be used, engineers are focused on practical issues, such as equipment reliability and productivity, mask defectivity, overlay, and wafer yield. Improvements are needed to have wafer costs using EUV lithography that are no higher than achieved with optical immersion triple patterning. Looking ahead to second generation EUV lithography, technology complexity increases significantly. For example, OPC will need to account for multiple consequences of mask 3D phenomena, affecting pattern placement as well as critical dimension control. Resist stochastic effects currently limit the resolution capability of EUV lithography. The extension of EUV lithography will require higher exposure doses to reduce these stochastic effects, but with attendant impact on productivity and process control. In spite of challenges, foundational capabilities with EUV lithography have been established, and we have potential for enabling the continued scaling of integrated circuits.

### **Presenting Author**

Harry J. Levinson is Sr. Director of GLOBALFOUNDRIES's Strategic Lithography Technology organization and Sr. Fellow. Dr. Levinson also served for several years as the chairman of the USA Lithography Technology Working Group that participated in the generation of the lithography chapter of the International Technology Roadmap for Semiconductors. He is the author of two books, *Lithography Process Control* and *Principles of Lithography*. He holds over 60 US patents. Dr. Levinson is an SPIE Fellow, previously chaired the SPIE Publications Committee, and served on SPIE's Board of Directors. He has a BS in engineering from Cornell University and a PhD in physics from the University of Pennsylvania. His PhD thesis, titled *Resonances and Collective Effects in Photoemission*, addressed certain phenomenon involving the interactions of light and matter. For this work he received the Wayne B. Nottingham Prize in surface science.

